Confinement and photocatalysis in geo-inspired nanotubes

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Hollow cylinders with a diameter in the nanometer range are carving out prime positions in nanosciences. Thanks to their physico-chemical properties, they could be key elements for next-generation nanofluidics devices, for selective molecular sieving, energy conversion or as catalytic nanoreactors. Some challenges such as diameter and interface control are solved for imogolite nanotubes (INTs). Belonging to clay minerals, imogolite exists in its natural state but is widely dispersed in environment, limiting its applications. The major breakthrough for using INTs was certainly their synthesis by sol-gel methods under mild conditions.

We will first focus here on the recent developments of INT synthesis, particularly in terms of morphological control and surface functionalization [1]. We will show that it is now possible designing innovative geo-inspired INTs with modular interfaces in a predictive way [2], which has recently led to some progress in the field of imogolite-based functional materials [3]. We will also prove that this system is ideal to investigate the structure and dynamics of water in interaction with the nanotube walls [4,5]. Finally, we will demonstrate that these nanotubes could be considered as potential photoactive nanoreactors, thanks to a unique polarization effect of their walls.

References

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